Two new species in the subgenus *Formotipula* Matsumura (Diptera: Tipulidae: *Tipula*) from China

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Abstract: Two new species in the subgenus *Formotipula* Matsumura, 1916, *T*. (*Formotipula*) *gongshanensis* **sp. nov.** from Yunnan and *T*. (*F*.) *medogensis* **sp. nov.** from Tibet, are described and illustrated. Males of *T*. (*F*.) *spoliatrix* Alexander, 1941 and *T.* (*F.*) *stoneana* Alexander, 1943 are redescribed and illustrated based on additional morphological characters. Females of *T.* (*F.*) *stoneana* and *T.* (*F.*) *decurvans* Alexander, 1950 are reported for the first time.

Key words: Nematocera; crane fly; taxonomy

中国丽大蚊亚属二新种（双翅目：大蚊科：大蚊属）

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摘要：记述采自云南和西藏的丽大蚊亚属 *Formotipula* Matsumura, 1916 二新种，贡山丽大蚊 *T*. (*Formotipula*) *gongshanensis* **sp. nov.** 和墨脱丽大蚊 *T*. (*F*.) *medogensis* **sp. nov.**，提供了新种的形态描述和特征插图。对黑角丽大蚊 *T*. (*F*.) *spoliatrix* Alexander, 1941 和斯通丽大蚊 *T.* (*F.*) *stoneana* Alexander, 1943 的雄虫进行了重新描述并补充了新的形态特征。同时，首次报道斯通丽大蚊 *T.* (*F.*) *stoneana* 和二叉弯尾丽大蚊 *T.* (*F.*) *decurvans* Alexander, 1950 雌虫。

关键词：长角亚目；大蚊；分类

Introduction

Formotipula was erected as a genus by Matsumura (1916), and was then degraded to a subgenus of *Tipula* Linnaeus by Edwards (1931). This is a small taxon with 30 species. The distribution range of most *Formotipula* species extends from Southeast Asia to southern China. The Chinese fauna of *Formotipula* is extremely rich with 20 species documented (Oosterbroek 2019). The most diagnostic feature for this subgenus is the striking body colors which are generally velvety black on thorax and orange or reddish orange on some basal abdominal segments (Young 2009). Working on Chinese taxa, Alexander successively reported 12 species of the subgenus *Formotipula* (Alexander 1924, 1931, 1933, 1935a, b, 1938, 1940, 1941, 1943, 1950). Edwards also focused on the Chinese crane fly fauna, successively documenting three species in this subgenus (Edwards 1916, 1926, 1932). Savchenko (1960) established a new subspecies based on specimens collected from the Chinese-Soviet zoological-botanical

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① Corresponding author, E-mail: menqiulei888@126.com expeditions of 1955–1957 to southwestern China. Young (2009) reported one new species from Taiwan, China. This subgenus has rarely been studied by Chinese taxonomists. So far, only Li *et al*. (2013) have described two new species from Guizhou and Sichuan, and constructed a key for all known species in this subgenus.

While sorting and identifying crane fly specimens collected from Yunnan and Tibet, two new species were found. In this paper, these two new species are described and illustrated. Males of *T.* (*F.*) *spoliatrix* Alexander, 1941 and *T.* (*F.*) *stoneana* Alexander, 1943 are redescribed and illustrated based on additional morphological characters. The females of *T.* (*F.*) *stoneana* and *T.* (*F.*) *decurvans* Alexander, 1950 are reported for the first time.

Material and methods

The specimens were collected with insect nets by the author. Photographs of body parts were taken with an Olympus SZ2-ILST stereomicroscope (Olympus, Japan). The hypopygium of each male was dissected and macerated in 10% NaOH for one hour at 50°C, observed in glycerin and illustrated with this same stereomicroscope. Dissection was made with the aid of two very fine needles, scissors and fine-tipped tweezers. Body measurements are from the vertex of head to the tip of the hypopygium. All measurements were made in millimeters (mm) with the aid of a digital caliper. The terminology and methods of description and illustration follow Alexander & Byers (1981), Frommer (1963), Gelhaus (2009) and de Jong (2017). The type specimens are deposited in the Systematics and Evolution Laboratory, School of Life Sciences, Anqing Normal University, Anhui Province, China.

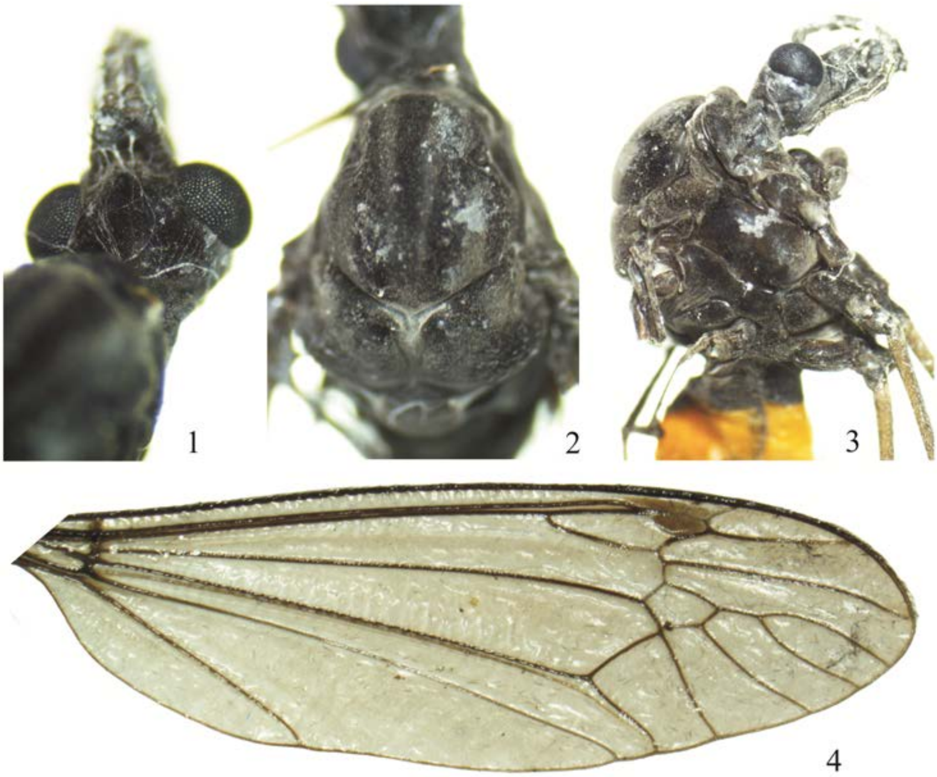
Taxonomy

1. ***Tipula* (*Formotipula*) *gongshanensis* sp. nov.** (Figs 1–14)

Description. Adult, length (male): body 8.4–8.6 mm (excluding antenna, $n = 2$); wing 11.9–12.0 mm ($n = 2$); antenna 3.4–3.6 mm ($n = 2$).

Head. Rostrum entirely black, nasus black, elongated, with many black setae on its apex. Vertex entirely black (Fig. 1). Antenna black throughout; scape subequal in length to the length of pedicel and first flagellomere together, narrowed basally and broadened apically; pedicel short, global; flagellum 10-segemented, each flagellomere subequal in length to each other, enlarged at base, verticils very long, the longest same length as flagellomere from which they arise. Palpus with basal three segments black, last segment dark gray, very long, slightly longer than head.

Thorax. Pronotum entirely black. Prescutum black with four dark gray stripes. Scutum black, each lobe with two dark gray areas (Fig. 2). Scutellum entirely dark gray. Postnotum wholly black. Pleuron entirely black (Fig. 3). Leg with coxa and trochanter black, same color as pleura; femur and tibia dark brown at basal one third, black at apical two thirds; tarsus black. Halter with stem dark brown, knob darker in coloration. Wing tinged with weak blackish, stigma dark brown, cells c and sc not darker than ground color (Fig. 4). Rs slightly longer than basal section of CuA_1, R_1 totally atrophied, r-m slightly longer than the basal deflection of R_5, M_{1+2} subequal in length to discal cell (Fig. 4).



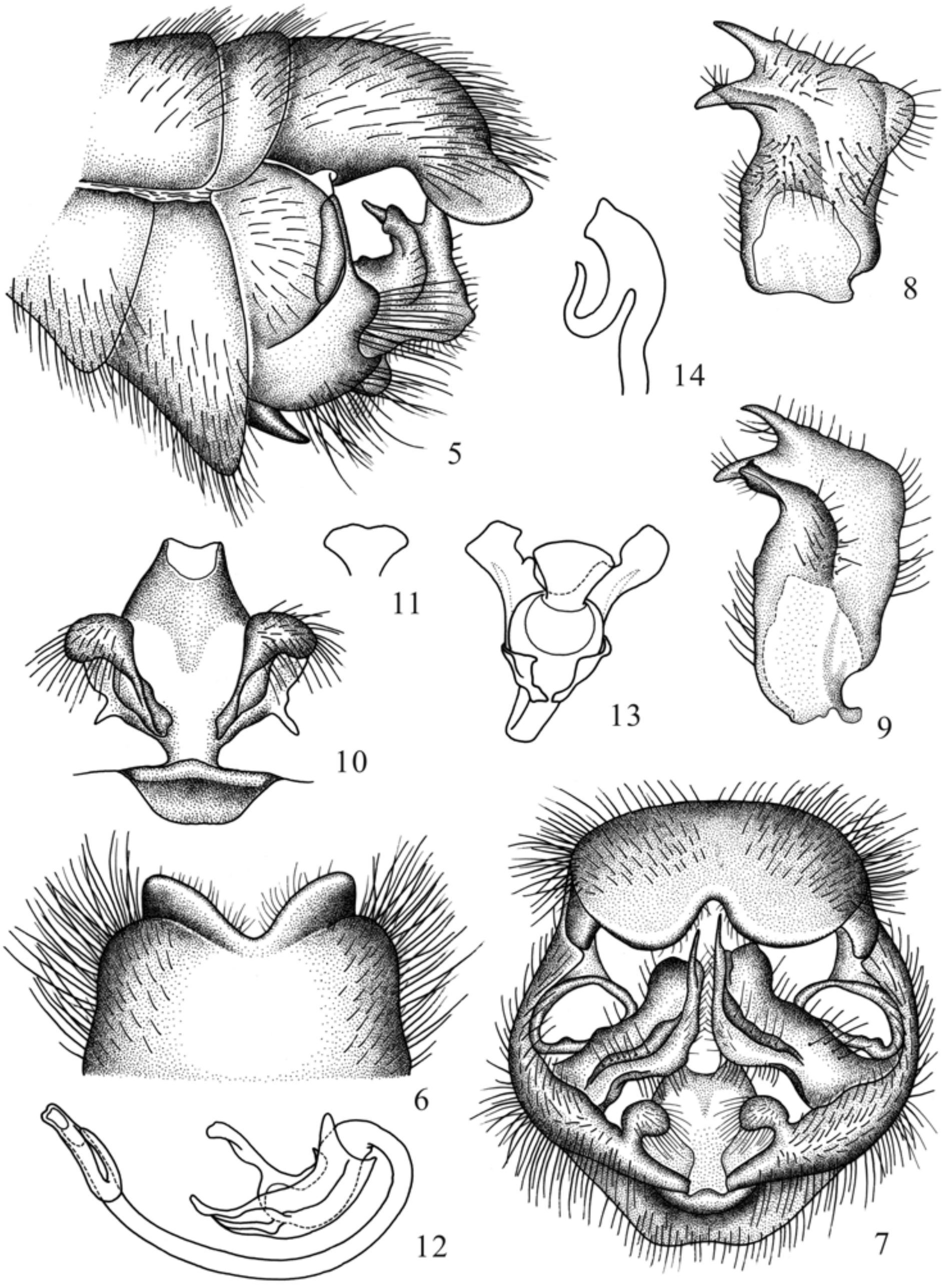
Figures 1–4. *Tipula* (*Formotipula*) *gongshanensis* **sp. nov.** 1. Head, dorsal view; 2. Thorax, dorsal view; 3. Thorax, lateral view; 4. Wing.

Abdomen. Abdomen with segment 1 black, segments 2 to 4 orange with black lateral stripes, distal segments including hypopygium black. Hypopygium relatively broad, tergite 9 and sternite 9 not fused (Fig. 5). Tergite 9 terminated into paired lobes, with a deep V-shaped notch between them, provided with many long setae on laterals (Figs 6, 7). Outer gonostylus absent. Inner gonostylus bearing 2 sharp spines, beneath them a black finger-shaped process, an obtuse lobe arising from the posterior corner; basal half thinner and more transparent than the remaining part (Figs 8, 9). Adminiculum broad basally, distinctly narrowed apically, protruded caudad at base in lateral view, with a pair of rods which are densely covered with long setae (Fig. 10). Sternite 9 protruded caudad in the mesal of caudal margin, possessing many long setae along the margin (Figs 5, 7, 10).

Semen pump. Semen pump with compressor apodeme very small, fan-shaped (Fig. 11). Posterior immovable apodeme enlarged apically, curved dorsally in lateral view (Fig. 12). Anterior immovable apodeme flattened, broad basally, narrowing to the end in lateral view (Figs 12, 13). Aedeagus relatively short, more than 2.5 times longer than semen pump, with a hook-shaped process on tip (Figs 12, 14).

Holotype. ♂, **China,** Yunnan, Gongshan County, Shuanglawa, 27°46' N, 98°37' E, 13-V-2019, leg. Qiulei MEN. **Paratype.** 1♂, same data as holotype.

Diagnosis. Head and thorax black in coloration, prescutum with four dark gray stripes, abdomen with segements 2 to 4 orange, distal segments black. Antenna black throughout. Tergite 9 terminates into a pair of lobes which are separated by a broad V-shaped notch.

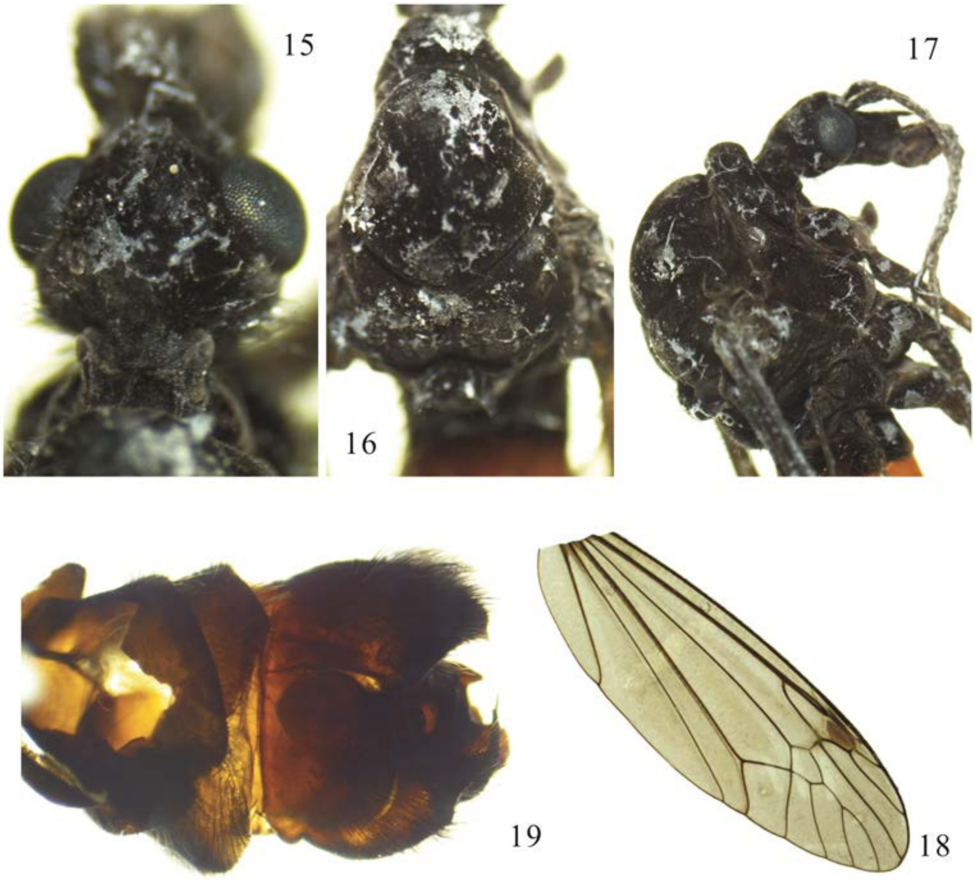


Figures 5–14. *Tipula* (*Formotipula*) *gongshanensis* **sp. nov.** 5. Hypopygium, lateral view; 6. Tergite 9, dorsal view; 7. Hypopygium, caudal view; 8. Inner gonostylus, inner lateral view; 9. Inner gonostylus, outer lateral view; 10. Adminiculum, ventral view; 11. Compressor apodeme, dorsal view; 12. Semen pump, lateral view; 13. Semen pump, dorsal view; 14. Apex of aedeagus, lateral view.

Remarks. This new species is most similar to another Chinese species, *Tipula* (*Formotipula*) *exusta* Alexander, 1931 from Sichuan, by the structure of hypopygium and venation. It differs from the latter by the following features: tergite 9 with paired lobes at caudal margin, with a deep V-shaped notch between them (tergite 9 produced on either sides of the median line into a smooth flattened black plate which is directed caudad in *Tipula exusta*); inner gonostylus terminated into 2 sharp spines, beneath them with a black finger-shaped process (inner gonostylus terminated into a beak, beneath it with an obtuse lobe in *Tipula exusta*).

Etymology. The specific epithet refers to the type locality, Gongshan County, Yunnan.

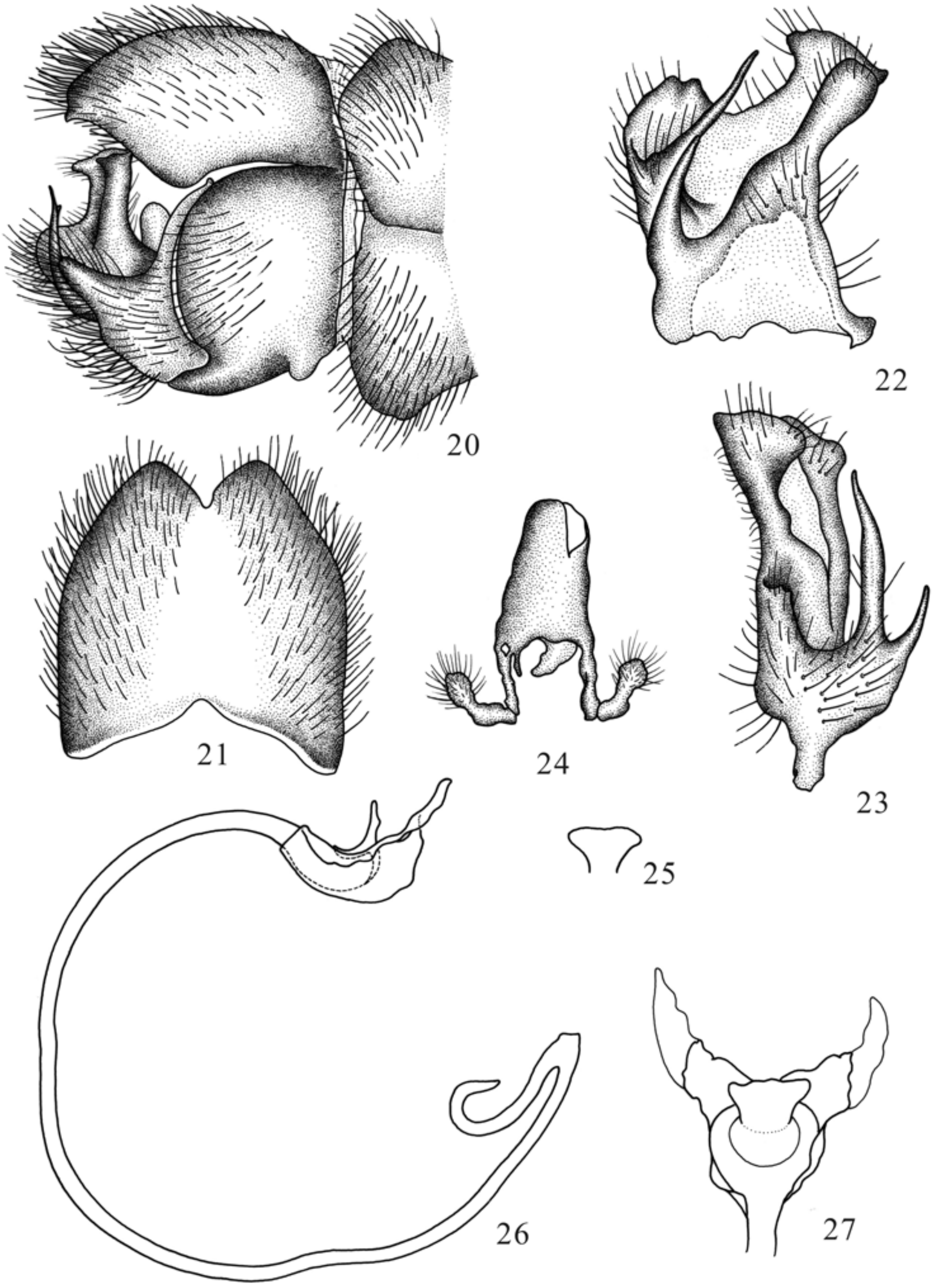
2. ***Tipula* (*Formotipula*) *medogensis* sp. nov.** (Figs 15–27)



Figures 15–19. *Tipula* (*Formotipula*) *medogensis* **sp. nov.** 15. Head, dorsal view; 16. Thorax, dorsal view; 17. Thorax, lateral view; 18. Wing; 19. Hypopygium, lateral view.

Description. Adult, length (male): body 14.4–14.6 mm (excluding antenna, $n = 2$); wing 18.2–18.4 mm ($n = 2$); antenna 4.1–4.3 mm ($n = 2$).

Head. Rostrum entirely black with black nasus very elongated, many black setae cover the rostrum and nasus. Vertex entirely black (Fig. 15). Antenna black throughout; scape longer than the length of pedicel and first flagellomere together, narrowed basally and broadened apically; pedicel short, global; flagellum 10-segemented, each flagellomere subequal in length to each other, enlarged at base, verticils very long, the longest same length as their corresponding flagellomere. Palpus dark gray, very long, almost as long as the length of head.



Figures 20–27. *Tipula* (*Formotipula*) *medogensis* **sp. nov.** 20. Hypopygium, lateral view; 21. Tergite 9, dorsal view; 22. Inner gonostylus, outer lateral view; 23. Inner gonostylus, caudal view; 24. Adminiculum, ventral view; 25. Compressor apodeme, dorsal view; 26. Semen pump, lateral view; 27. Semen pump, dorsal view.

Thorax. Pronotum entirely black. Mesonotum including prescutum black throughout, without stripes (Fig. 16). Pleuron wholly black (Fig. 17). Leg with coxa and trochanter black, same color as pleuron; femur and tibia dark brown with apex black respectively; tarsus black. Halter entirely black. Wing with weak blackish tinge, stigma dark brown, cells c and sc not darker than ground color (Fig. 18). Rs slightly longer than basal section of CuA_1, R_1 preserved at basal half, atrophied at apical half, r-m almost reaching the fork point of Rs, M_{1+2} subequal in length to discal cell (Fig. 18).

Abdomen. Abdomen with tergite 1 black at base and orange at apex, with sternite 1 orange totally; segments 2 to 4 orange, narrowly margined in black on sides; segment 5 orange basally and black apically, distal segments including hypopygium black. Hypopygium relatively large with tergite 9 and sternite 9 separated from each other (Figs 19, 20). Tergite 9 broad, densely covered with black setae on dorsal surface, concaved medially into a V-shaped notch (Fig. 21). Gonocoxite connected with sternite 9 along its caudal margin, broad basally and then narrowing to a sharp end which is pointed caudad, equipped with long setae on its ventral margin (Fig. 20). Outer gonostylus absent. Inner gonostylus being a broad lobe, terminating into 2 lobes which are close to each other, one of which is rounded, the other decurved, with 2 spines generated from mesal of ventral margin; a relatively thinner and more transparent area on the basal half (Figs 22, 23). Adminiculum broad basally, slightly narrowing to apex, possessing pair of small rods at base which are densely covered with long setae (Fig. 24).

Semen pump. Semen pump with compressor apodeme very small, fan-shaped (Fig. 25). Posterior immovable apodeme broad basally, narrowed to tip, curved dorsally in lateral view (Fig. 26). Anterior immovable apodeme flattened, very small (Fig. 27). Aedeagus tubular, more than 7.0 times longer than the length of semen pump, with a hook-shaped process on tip, subequal in length to semen pump (Fig. 26).

Holotype. ♂, **China,** Tibet, Medog County, 29°19' N, 95°20' E, 03-VI-2019, leg. Qiulei MEN. **Paratype.** 1♂, same data as holotype.

Diagnosis. Head and thorax black in coloration, abdomen with segements 2 to 4 and base of segment 5 orange, distal segments black. Antenna black throughout. Tergite 9 concave medially at caudal margin into a V-shaped notch; gonocoxite broad basally, narrowed to a sharp terminal.

Remarks. This new species is allied to an Indian species *Tipula* (*Formotipula*) *rufoabdominalis* Alexander, 1927 by the shape of tergite 9 which is concaved into a deep V-shaped notch, and by the shape of inner gonostylus. It can be separated from the latter by the shape of the gonocoxite which is broad basally and then narrows to a sharp end. In *T.* (*F.*) *rufoabdominalis,* the gonocoxite is relatively smaller and not protruded.

Etymology. The specific epithet is a noun '*medog*' with Latin suffix '*ensis*', referring to the type locality of the new species.

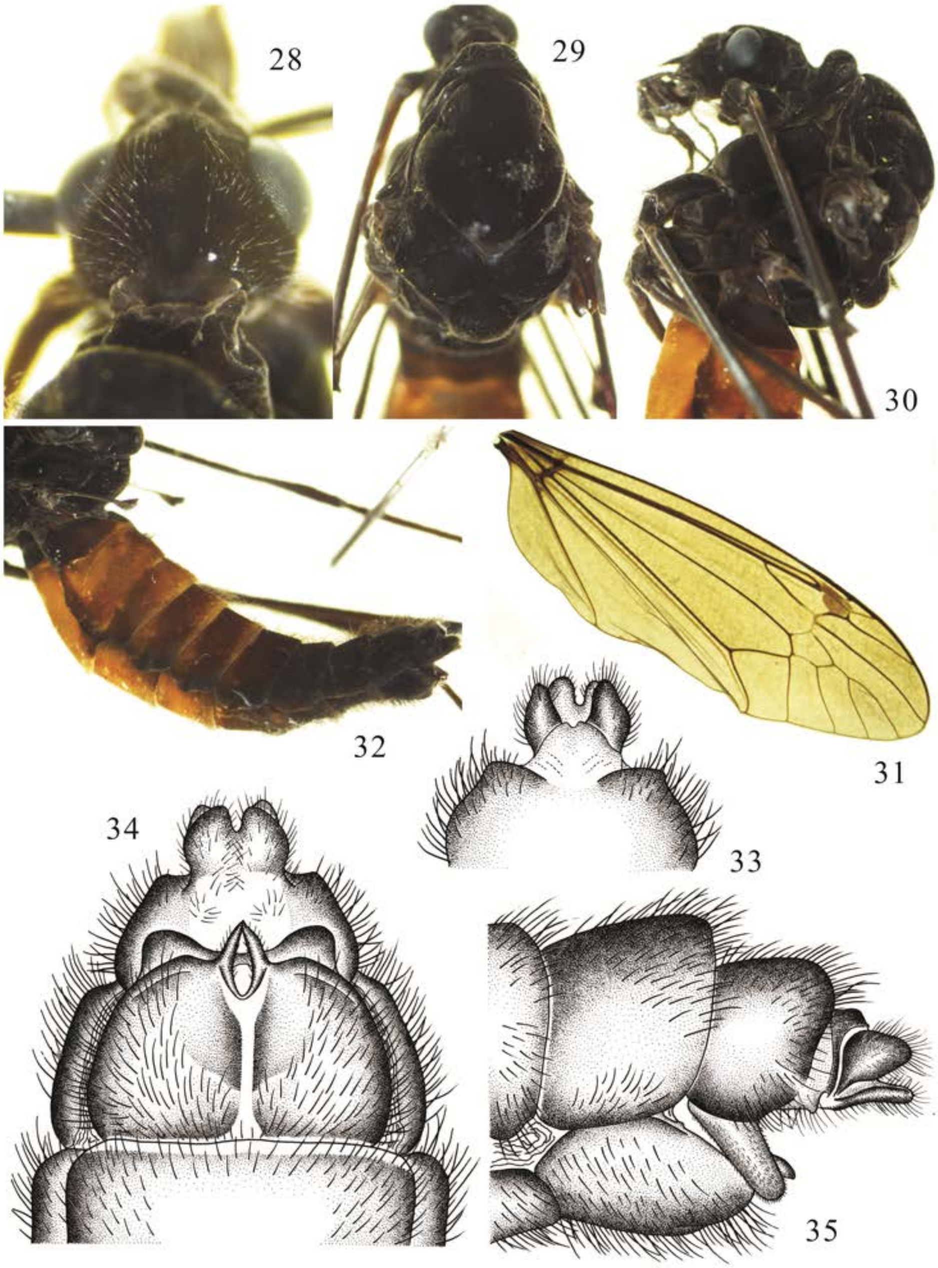
3. ***Tipula* (*Formotipula*) *decurvans* Alexander, 1950** (Figs 28–35)

Tipula (*Formotipula*) *decurvans* Alexander, 1950: 677 (original description).

Description. Adult, length (female): body 13.4–13.6 mm (excluding antenna, *n* = 13); wing 18.3–18.6 mm (*n* = 13); antenna 3.3–3.5 mm (*n* = 13).

Head. Head black generally, thinly dusted with whitish. Rostrum entirely black with black nasus densely covered with black setae (Fig. 28). Vertex entirely black (Fig. 28).

Antenna black throughout; scape longer than the length of pedicel and first flagellomere together, narrowed basally and broadened apically; pedicel short, global; flagellum 10-segemented, each flagellomere subequal in length to each other, verticils very long, the longest distinctly longer than their corresponding flagellomere. Palpus black, basal segments broad apically, almost as long as the last segment.



Figures 28–35. *Tipula* (*Formotipula*) *decurvans*, ♀. 28. Head, dorsal view; 29. Thorax, dorsal view; 30. Thorax, lateral view; 31. Wing; 32. Abdomen, lateral view; 33. Sternite nine and cercus, dorsal view; 34. Ovipositor, ventral view; 35. Ovipositor, lateral view.

Thorax. Pronotum black throughout, whitish pruinose. Prescutum blackish with 3 blackish polished stripes. Interspace between median and lateral stripes whitish pruinose, with short pale setae (Fig. 29). Scutum blackish with 2 blackish-gray regions, whitish pruinose (Fig. 29). Scutellum blackish, strongly whitish pruinose (Fig. 29). Pleura black, thinly dusted with whitish on the base of katepisternum, meron, 2nd and 3rd coxae (Fig. 30). Legs black throughout. Wing uniformly brownish-gray with stigma dark brown (Fig. 31). R_1 present, Rs relatively short and straight, same length to R_4; R_{2+3+4} curved medially; discal cell short and broad, petiole of cell m_1 half the length of discal cell; basal section of CuA_1 connecting with the base of M_4. Halter with stem dark brown, with knob black (Fig. 31).

Abdomen. Abdominal segement 1 black, segments 2 to 4 orange, suffused with brownish on posterior and lateral margins, distal segments including ovipositor black (Fig. 32).

Ovipositor. Ovipositor with tergite 9 short, broad basally in dorsal view (Fig. 33). Cercus short, apically rounded (Fig. 33). Sternite 9 shallowlly emarginated at posterior margin, forming two round lobes in ventral view (Fig. 34). Sternite ten with a deeply V-shaped notch medially, forming 2 round lobes (Fig. 34). Sternite 8 rounded, slightly broad at base, with hypogynial valve short and seta-shaped (Fig. 34). Sternite ten with a deeply V-shaped notch medially, forming 2 round lobes, nested below cercus (Figs 34, 35).

Specimens examined. 13♀, **China,** Tibet, Nyingchi City, Zayu County, Cibagou National Nature Reserve, 28°53′ N, 97°27′ E, 06-VI-2019, leg. Qiulei MEN.

Diagnosis. Head and thorax black, abdomen with segements 2 to 4 orange, distal segments black. Wing uniformly brownish-gray with stigma dark brown. Cercus short, apically rounded; sternite 10 with a deeply V-shaped notch medially, forming 2 round lobes.

Remarks. Comparing the structure of the ovipositor to the related species *Tipula* (*Formotipula*) *holoserica* (Matsumura, 1916), *Tipula* (*Formotipula*) *decurvans* has shorter lobes on lateral corner of tergite 9 (terminating into 2 elongated lobes on tergite 9 in former), has shorter and rounded lobes on sternite 9 (terminating into 2 long and truncated lobe in former), and also has sternite ten with adeeply V-shaped notch medially (sternite ten totally divided by notch in former).

Distribution. China (Guizhou; Tibet, new record); Vietnam.

4. ***Tipula* (*Formotipula*) *spoliatrix* Alexander, 1941** (Figs 36–46)

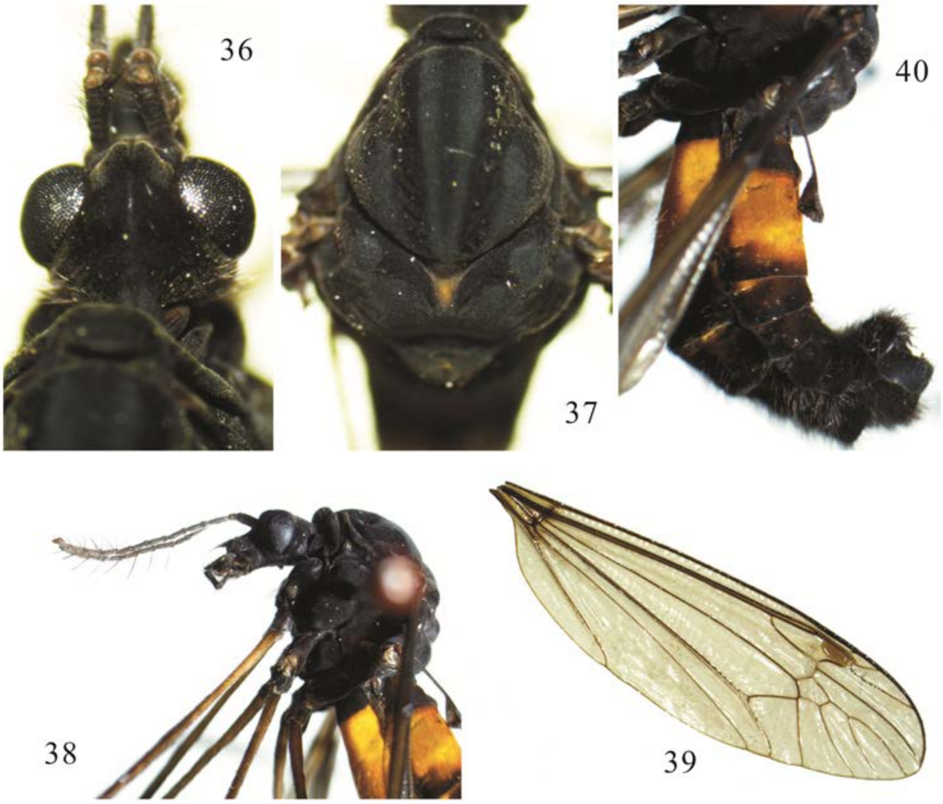
Tipula (*Formotipula*) *spoliatrix* Alexander, 1941: 387 (original description).

Redescription. Adult, length (male): body 12.2–12.4 mm (excluding antenna, $n = 2$); wing 14.4–14.6 mm ($n = 2$); antenna 4.0–4.2 mm ($n = 2$).

Head. Head black entirely (Fig. 36). Antenna black throughout, flagellomeres subequal in length to each other, slightly expanded basally, verticils long, the longest distinctly as long as their corresponding flagellomere.

Thorax. Pronotum black (Figs 36, 37). Prescutum black with 4 dark gray stripes (Fig. 37). Scutum black with two dark gray marks (Fig. 37). Scutellum entirely dark gray. Postnotum wholly black. Pleuron black, sparsely pruinose (Fig. 38). Legs black. Wing suffused with weak blackish, stigma dark brown (Fig. 39).

Abdomen. Abdomen with segment 1 black, tergite 2 orange with brownish black tinge on sides and posterior margin, sternite 2 orange, suffused with brownish black on posterior margin, segments 3 and 4 orange basally, gradually changing to brownish black apically, distal segments including hypopygium intensively black (Fig. 40).



Figures 36–40. *Tipula* (*Formotipula*) *spoliatrix*. 36. Head, dorsal view; 37. Thorax, dorsal view; 38. Thorax, lateral view; 39. Wing; 40. Abdomen, lateral view.

Hypopygium. Hypopygium relatively compact (Figs 40, 41). Tergite 9 enlarged, with many long setae along lateral and caudal margins, caudal margin having a pair of black points, between them with 6 or 7 smaller points (Figs 41–43). Gonocoxite small (Fig. 41). Outer gonostylus absent. Inner gonostylus being flaky, basal half more transparent than apical half, terminated into a curved beak, bearing 2 black spines generated from base and top respectively, the basal one longer than the apical one (Fig. 44).

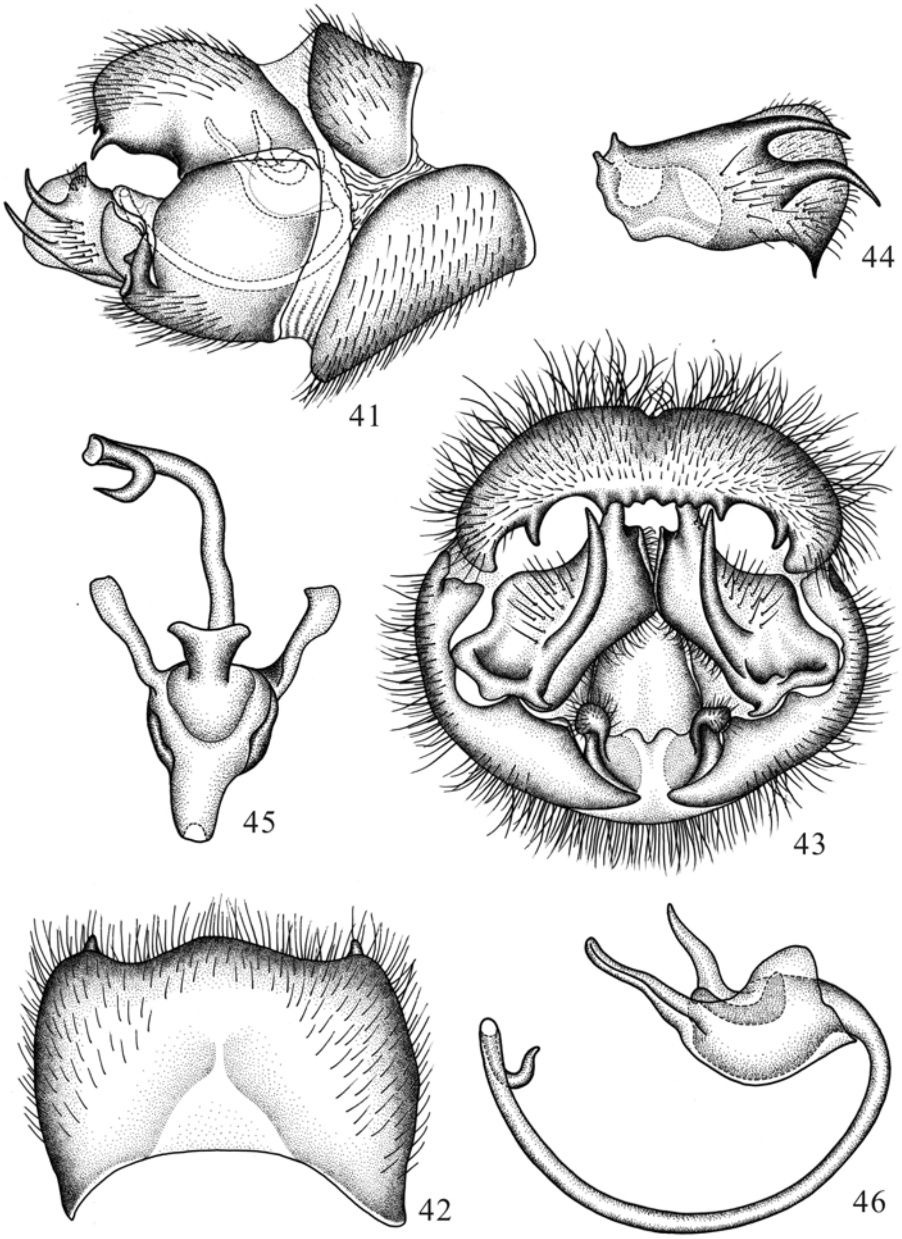
Semen pump. Semen pump with compressor apodeme very small, fan-shaped (Fig. 45). Posterior immovable apodeme being a narrowed rod (Fig. 45). Anterior immovable apodeme flattened, expanded in lateral view (Fig. 46). Aedeagus tubular, more than 2.0 times longer than the length of semen pump, with a hook-shaped process on apex (Fig. 46).

Species examined. 2♂, **China,** Guangxi, Jinxiu County, Lianhuashan Mountain, 24°09' N, 110°06' E, 14-V-2016, leg. Qiulei MEN.

Diagnosis. Head and thorax black generally. Abdomen with segments 3 and 4 orange at base, gradually changing to brownish black apically, distal segments including hypopygium intensively black. Tergite 9 enlarged, caudal margin with a pair of black points, between them with 6 or 7 smaller points.

Remarks. In original description, tergite 9 has 6 small points. However, in the author's observation, there are 8 or 9 points. The species reveals distinct intraspecific variation in the number of points in different individuals.

Distribution. China (Fujian; Guangxi, new record).



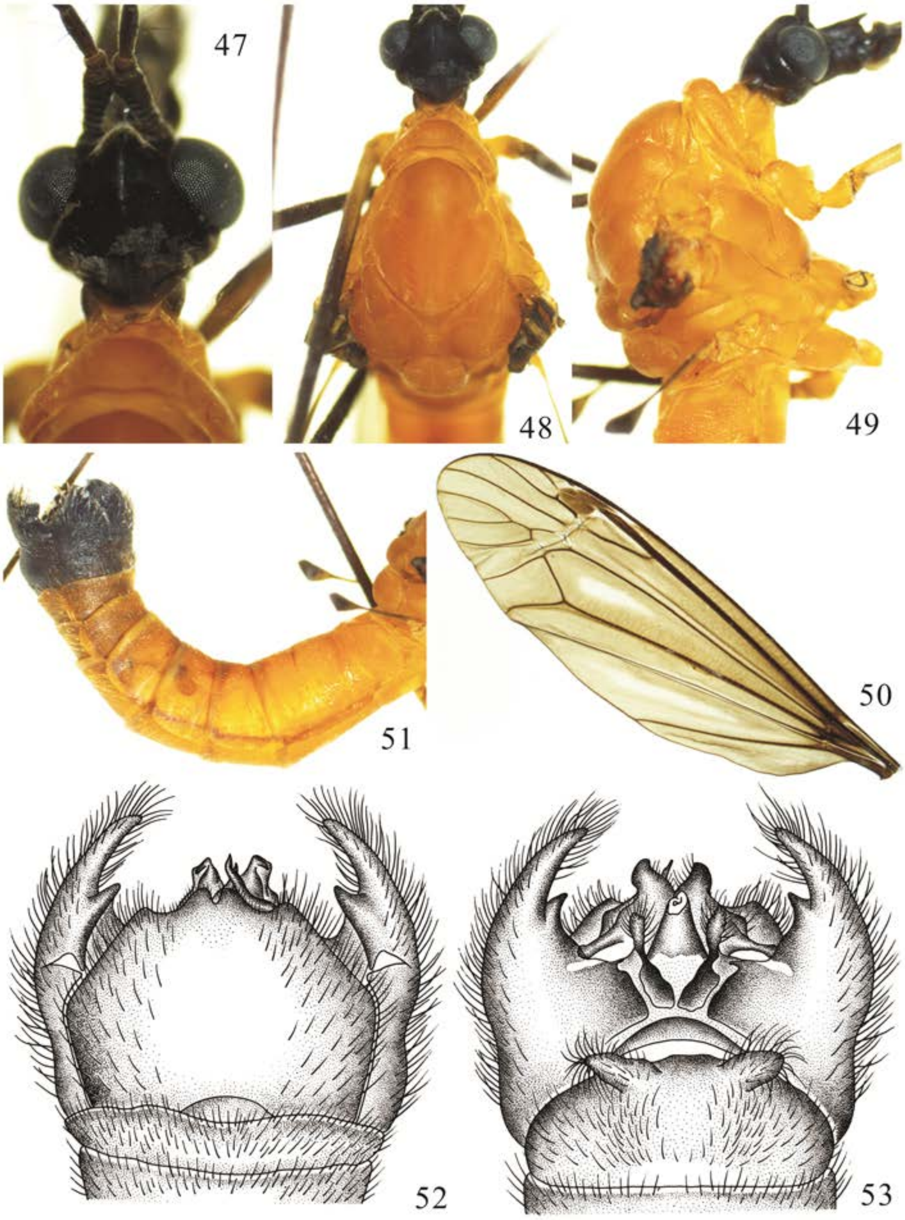
Figures 41–46. *Tipula* (*Formotipula*) *spoliatrix*. 41. Hypopygium, lateral view; 42. Tergite 9, dorsal view; 43. Hypopygium, caudal view; 44. Inner gonostylus, outer lateral view; 45. Semen pump, dorsal view; 46. Semen pump, lateral view.

5. ***Tipula* (*Formotipula*) *stoneana* Alexander, 1943** (Figs 47–64)

Tipula (*Formotipula*) *stoneana* Alexander, 1943: 174 (original description).

Redescription. Adult, length (male): body 16.5–18.5 mm (excluding antenna, *n* = 15); wing 18.0–24.4 mm (*n* = 15); antenna 4.2–4.4 mm (*n* = 15).

Head. Head black (Fig. 47). Antenna blackish except the scape paler.



Figures 47–53. *Tipula* (*Formotipula*) *stoneana*. 47. Head, dorsal view; 48. Thorax, dorsal view; 49. Thorax, lateral view; 50. Wing; 51. Abdomen, lateral view; 52. Hypopygium, dorsal view; 53. Hypopygium, ventral view.

Thorax. Pronotum yellow totally (Fig. 48). Prescutum yellow with 3 light yellow stripes (Fig. 48). Scutum yellow with 2 triangular polished areas (Fig. 48). Scutellum yellow (Fig. 48). Pleuron yellow throughout (Fig. 49). Leg with coxa, trochanter and base of femur orange, same color as pleuron, the rest black. Wing blackish with stigma black, with bright areas on bm and cup (Fig. 50). R_1 present, Rs relatively short, as long as R_4, R_{2+3+4} curved at base, discal cell short and broad, petiole of cell m_1 distinctly shorter than discal cell (Fig. 50). Halter with stem brownish, knob black.

Abdomen. Abdomen with 1 to 7 segments yellow, 5 to 7 segments suffused with brownish on tergites, 8 segments and hypopygium wholly black (Fig. 51).

Hypopygium. Hypopygium massive, sternite 9 and tergite 9 separated from each other totally. Tergite 9 massive, broad medially, median region of the posterior margin with a small V-shaped notch, forming 2 submedian lobes which are sharply acute and curved ventrad in lateral view (Figs 52–54); under the submedian lobes with strong extension in ventral view (Fig. 55). Gonocoxite connecting sternite 9 at upper area, produced caudad into a thumb-like lobe, tip obtuse with abundant long setae, with a broad lobe at base which is also densely covered with long setae (Figs 52–54). Outer gonostylus absent. Inner gonostylus tapering into an acute point, near the point with a pale lobule which has a transparent membrane; the posterior corner bearing a heavily blackened lobe, terminating to a sharp hook, a black ridge connects the hook and extends to median region, from the base of the ridge a narrowed and black arm is generated, its tip produced into an acute apex (Fig. 56). Sternite 8 rounded, with 2 elongated finger-shaped lobes at posterior margin, apex of lobe rounded and expanded, densely covered with long setae (Fig. 57). Adminiculum broad basally, distinctly narrowed apically, with a pair of black rods which are densely covered with long setae (Fig. 53).

Semen pump. Semen pump with compressor apodeme very small, fan-shaped, truncated apically (Fig. 58). Posterior immovable, broad and truncated apically (Fig. 59). Anterior immovable apodeme flattened and small in lateral view (Fig. 60). Aedeagus tubular, more than 2.0 times longer than semen pump, abruptly broad in median area, apex acute, with a truncated process on apex (Figs 60, 61).

Female. Body 17.5–19.6 mm (excluding antenna, $n = 17$); wing 18.4–23.4 mm ($n = 17$); antenna 3.0–3.4 mm ($n = 17$).

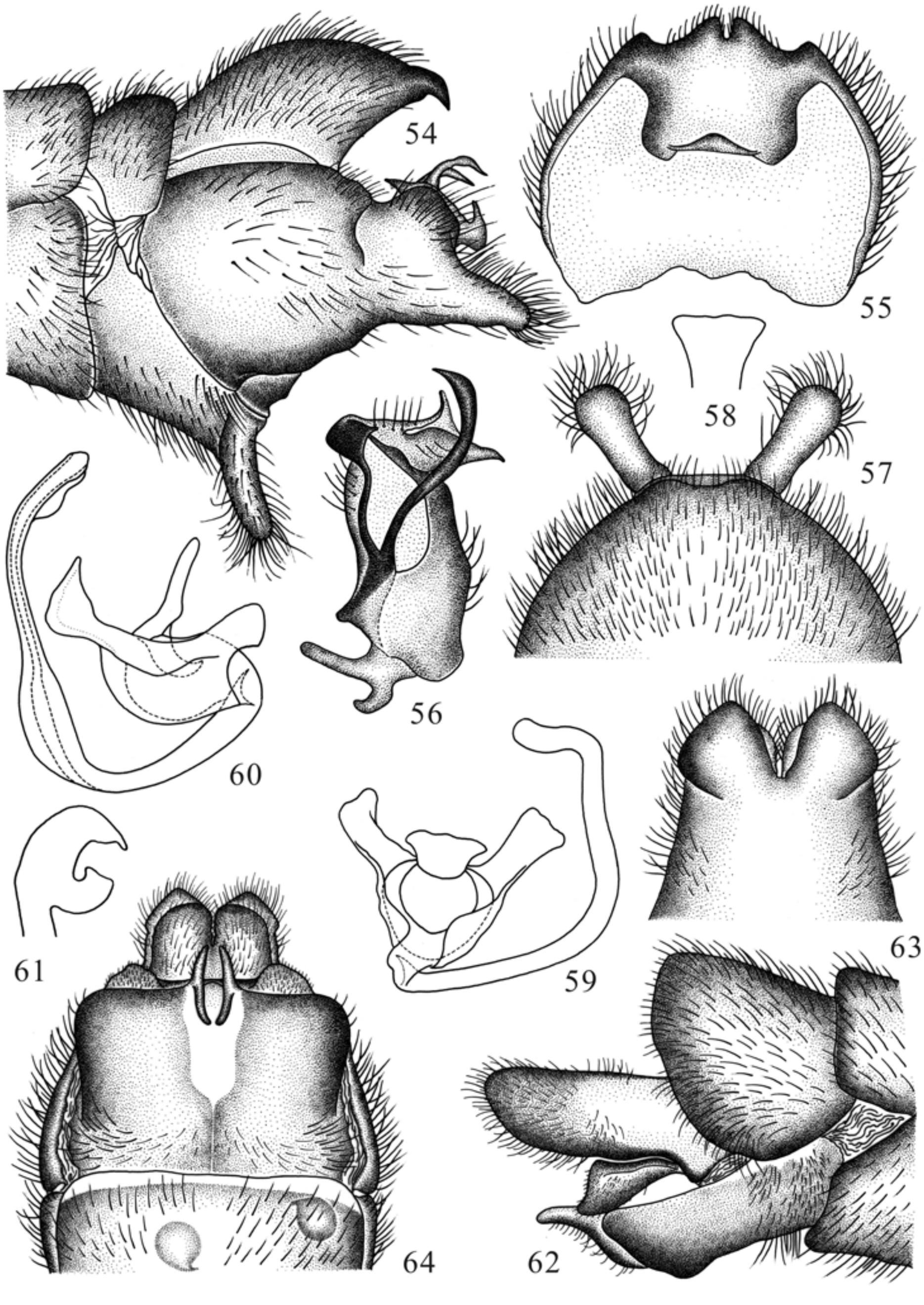
Coloration. The general coloration of head, thorax and abdomen similar to that of male.

Ovipositor. Ovipositor with tergite 9 short, vertical to cercus, nested below the tergite 8, invisible in lateral view. Cercus long, straight in lateral view, apically truncated (Figs 62, 63). Sternite 9 shallowly emarginated at posterior margin, forming 2 round lobes in ventral view (Fig. 64). Sternite 10 with a deeply V-shaped notch medially, forming 2 round lobes (Fig. 64). Sternite 8 truncted at posterior margin, with hypogynial valve short and seta-shaped (Fig. 64). Sternite ten with a deeply V-shaped notch medially, bearing 2 round lobes, nested below cercus (Fig. 64).

Specimens examined. 15♂, **China,** Yunnan, Gongshan County, Bingzhongluo, 28°01' N, 98°37' E, 12-VI-2019, leg. Qiulei MEN. 17♀, females, same data as males.

Diagnosis. Head black. Thorax orange. Abdomen with 1 to 7 segments orange, the rest black in both sexes. Wing blackish with black stigma. Male hypopygium with sternite 8 bearing 2 finger-shaped lobes; gonocoxite elongated.

Distribution. China (Yunnan).



Figures 54–64. *Tipula* (*Formotipula*) *stoneana*. 54. Hypopygium, lateral view; 55. Tergite 9, ventral view; 56. Inner gonostylus, outer lateral view; 57. Sternite 8, ventral view; 58. Compressor apodeme, dorsal view; 59. Semen pump, dorsal view; 60. Semen pump, lateral view; 61. Apex of aedeagus, lateral view; 62. Ovipositor, lateral view; 63. Cercus, dorsal view; 64. Ovipositor, ventral view.

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